1990. Vertebrate Pest Management, a Training Manual, Joe E. Brooks, Ejaz Ahmad, Iftikhar Hussain, Shahid Munir and A. Aziz Khan, editors, pgs. 67-71.

RODENT PROOFING AND EXCLUSION METHODS IN GRAIN GODOWNS

By Joe E. Brooks and Iftikhar Hussain

A. Introduction

Rats, mice and birds are commonly regarded as vertebrate pests of stored foods worldwide. Losses of grains after harvest are considered equally as important as the losses that occur in the fields before harvest. The poorer the quality of storage conditions, the more likely that the grain stores are infested and the losses become serious.

In Pakistan, wheat is the major grain crop grown, harvested and consumed each year. Out of approximately 14 million metric tons (mt) produced, about 5 to 6 million mt are procured by the provincial food departments and the Pakistan Agricultural Storage and Services Corporation (PASSCO) and stored for periods ranging from one to 12 months until redistributed to the wheat-deficient areas of the country. Another 5 to 6 million mt remains in the hands of the growers, farmers, for their family consumption and for seed for the next season. One to two million tons are sold on the market immediately after harvest.

The quality of the provincial and PASSCO storage facilities and the severity of vertebrate pest infestations in the storage centres were surveyed by the Vertebrate Pest Control Project in 1986. In general, although the provincial storage facilities were in varying degrees of repair and in need of better physical maintenance, the consequent vertebrate pest problems were not considered severe. Total losses due to both rodents and birds were estimated to be only 0.3% to 0.6% of total stocks in storage, a total potential loss of 12 to 24 thousand mt throughout the country. However, even this minimal loss could be cut further through the use of proper pest-proofing and better physical repair and maintenance of the existing facilities.

B. Type of Problems Found

The kinds of structural defects noted in the provincial and PASSCO grain storage facilities are given in Table 1. For vertebrate pest infestations, the doors and windows are the most critical, since

Table 1: Structural Defects Noted in Provincial and PASSCO Grain Storage Facilities

Agency	No. Godowns Examined	Percent with Defects				
		Doors	Windows	Floors	Walls	Roofs
Punjab	181	35.9	34.2	47.5	51.9	17.7
Sind	85	78.8	34.1	76.5	88.2	7.1
NWFP	46	76.1	78.3	84.8	93.5	39.1
Baluchistan	24	70.8	66.7	50.0	66.7	16.7
PASSCO	56	17.8	0.0	1.8	30.4	0.0
Totals	392	49.5	36.5	51.8	60.7	15.6

these are the points of entry for the animals (rats, mice and birds). As is seen, almost 50% of the godowns inspected had doors in poor repair or ill fitting so that rodents and/or birds could easily move

into the structures. More than one-third of the godowns had missing screens or window glass, allowing easy entry by sparrows and pigeons.

Simple rodent- and bird-proofing measures are obviously needed in order to keep vertebrate pests out of grain storage facilities. It is best if these are designed as part of the original structure when it is built. Unfortunately, this is rarely done and proofing, or exclusion measures must be done later. We will briefly review the rodent- and bird-proofing measures that can be used in grain godowns.

C. Rodent-Proofing Measures

1. Rodent-Guard

The ideal way to keep rodents out of grain storage structures is to deny them access to the structure itself. This idea was incorporated into the design of the PASSCO house-type godowns where a rodent-guard was built into the structure (Fig. 1). The rodent-guard is an extension of the floor so that a shelf of smoothed concrete protrudes approximately 30 cm outward from the entire structure and is about 1 meter above ground. Rodents attempting to climb the foundation walls of the structure (as house mice and roof rats can do) will encounter the protruding guard and are unable to gain access to the doorways. In addition, the loading dock is built without stairs. This prevents rodents from gaining access to the dock and thereby entering the doors. A removable ramp is used to allow godown personnel access to the dock during the day. The entire purpose of the rodent-guard is defeated if stairs are built or placed next to the dock and left there. The rodent-guard is one of the important factors in why PASSCO godowns had very low rodent infestations when inspected in November 1986.

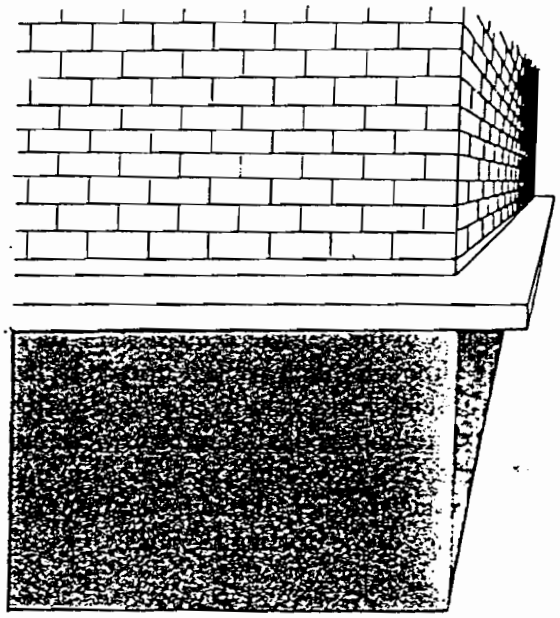

Fig. 1. PASSCO-type rodent-guard.

2. Doors

Probably more rats and mice gain entry to buildings through defective doors than by any other means. The doors usually are not fitted properly to keep rodents out or have become damaged and no longer close tightly. Doors should have no more than 1/4 inch (6.5 mm) clearance above the sill in order to exclude mice and rats (see Fig. 2 to see clearances for rat and mouse exclusion). If the doors are on tracks, they should close so that no space more than 1/4 inch is allowed. Doors should be fitted tightly into their sills and jambs so that total interior fumigation with phosphine can be done with a minimum of sealing around the doorway.

Fig. 2. Rats can given entry through holes as small as 1/2 inch (1.3 cm) in diameter; mice can get through a hole 1/4 inch (6.5 mm) in diameter.

The use of an inner door made of grilled mesh or expanded metal will keep out rodents and birds when there is need for the outer doors to be opened (Fig. 3), for instance for ventilation purposes. These are fitted inside the regular doors and swing inward.

Birds can be prevented from entering open doorways and those required to be constantly open during working hours by installing a vinyl plastic strip door, which allows persons or machinery to pass easily through but stops birds from doing so (Fig. 4).

3. Windows

Broken window glass and broken or missing screens are the means by which house sparrows and pigeons may most easily enter godown interiors. Screening of windows can be done with a variety of materials, including ordinary fly-screening in nylon or metal mesh, poultry mesh of small aperture or nylon or other netting. Screening can be done to individual windows or the entire row of windows could be screened as shown in Fig. 5. This kind of screening can be swung out of the way when there is a need to mud-plaster the windows for godown fumigation.

4. Ledges and Perches

Birds can be discouraged from using godown interiors by preventing them from landing and resting on ledges and perches on the buildings. Materials called porcupine wires are a relatively permanent method of keeping pigeons from roosting on structures. They are composed of many spring-tempered stainless steel prongs with sharp points extending outward at all angles. The prongs are fastened to a solid base which can be installed on window sills, ledges, eaves, roof peaks or wherever pigeons are prone to roost (Fig. 6). These sharp pointed wires inflict temporary discomfort and cause pigeons to avoid landing on these surfaces. In a few cases pigeons have been known to cover the wires with nesting materials, so they must be maintained. Although these devices and their installation can be expensive, the more permanent results may justify the cost.

A simpler way to keep pigeons from roosting on ledges is to fix a board or piece of sheet

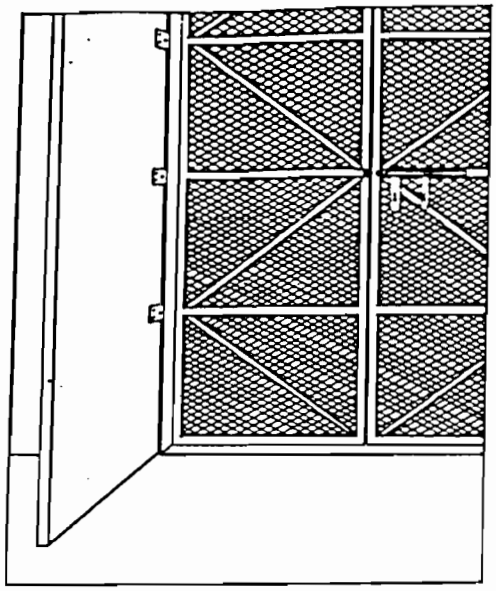

Fig. 3. Grilled inner doors keep out both rodents and birds.

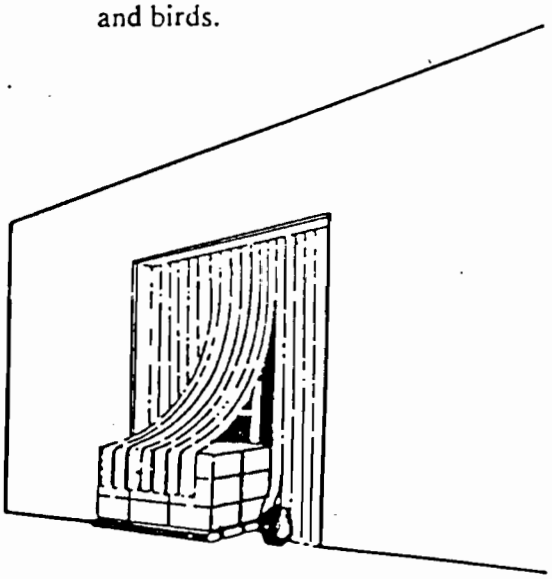

Fig. 4. Vinyle plastic strip doors stop birds from entering.

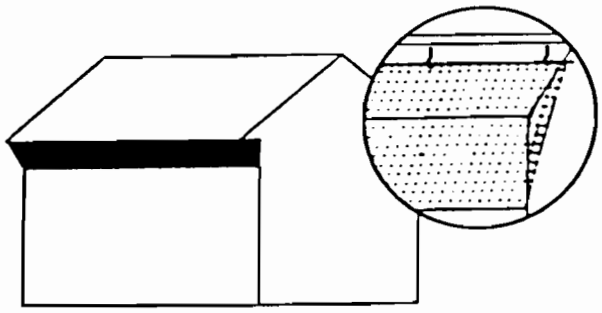

Fig. 5. Hinged screen for windows stops birds.

metal at a 45-degree angle across the bottom of the ledge (Fig. 7).

5. Pipes

Any place where pipe or electrical conduit enters the walls will have to be rodent- proofed. Sometimes these are installed after the structure is built and a hole has to be knocked in the wall. These openings should be sealed with either a plate of sheet metal, cut to fit tightly around the pipe and fastened securely to the wall, or the opening should be closed with cement (Fig. 8).

6. Drains

If the godown has floor drains allowing for runoff of wash water when the interior is cleaned, these will require grills or drain covers to keep rodents from entering by the drainage pipe (Fig. 9). These should be installed flush with floor so they do not become damaged by machinery used inside the godown. They should be hinged or screwed down so they can be lifted occasionally for cleaning.

If roof drain pipes are present on the outside of the godown, these need rat-guards installed to prevent rats from gaining access to the roof. Several types of sheet metal rat-guard that will stop rats from climbing a drain pipe are shown in Fig. 10. These are fitted over the outside of the pipe and fastened securely to the outer wall.

D. Maintenance of Rodent- and Bird-Proofing

Once a godown is completely rodent- and bird-proofed, then if rodents are inside, they should be eliminated. Either 1) fumigate the entire structure with phosphine, or 2) place anticoagulant or zinc phosphide baits packed in polythene bags inside at all places where rodents will find them and keep them out for two weeks or until no further bait takes are seen, or 3) place baited kill traps at all spots where rodents would be expected to travel. Continue trapping until no additional animals are captured.

Inspect the inside of the godown and close all cracks or holes where rodents might hide or burrow. Make certain that no holes connect with the outside of the structure. If they do, close them off with good quality cement made into concrete. Concrete floors are best inside for where grain is to

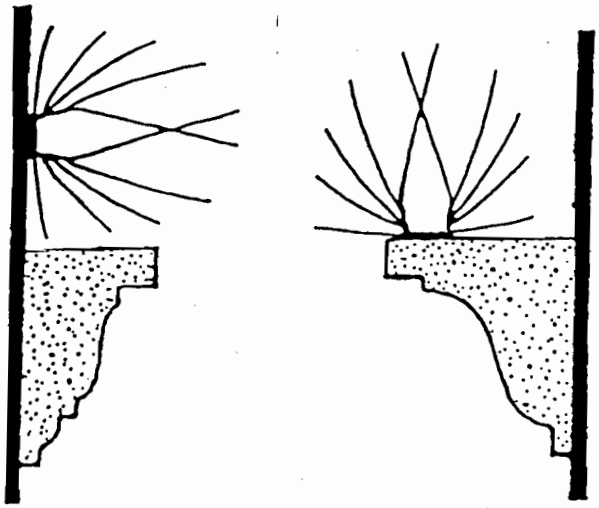

Fig. 6. Porcupine wires discourage birds from landing.

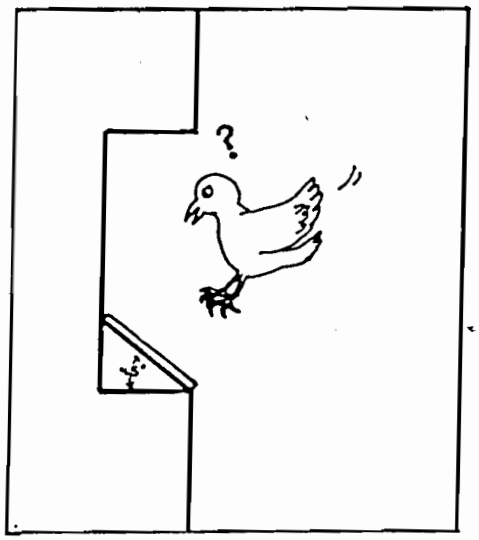

Fig. 7. An angled board or metal plate discourages roosting.

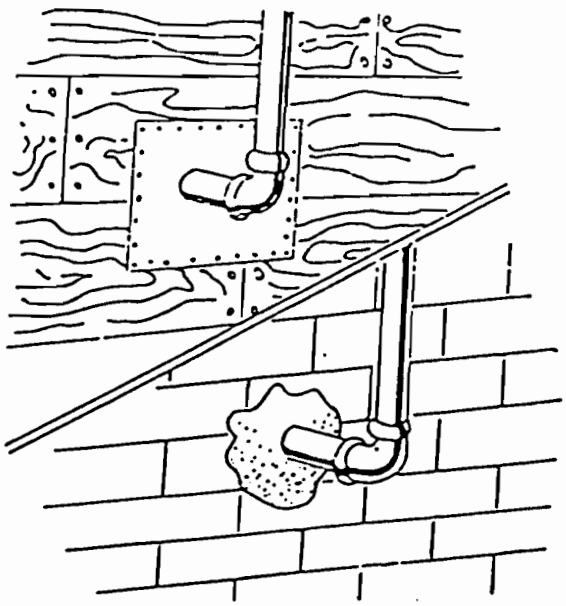

Fig. 8. Rodent-proofing of pipes.

be stored. Replace interior dirt or wooden floors with concrete to avoid pest problems.

When the godown or grain storage facility is rodent- and bird-proofed, it is important that the improvements be maintained. Doors and windows need to be kept in good repair and not allowed to become defective. If screening is torn or otherwise damaged, it should be repaired or replaced. Rat-guards and collars on drain pipes should be inspected regularly and made sure that they are intact. Ledges and shelves where birds may roost or nest should be inspected and steps taken to keep the bird-proofing intact. Floor drain grills should be in place and kept clean. Maintenance of proofing measures will require a regular inspection of all perimeter points where birds or rodents might enter the structure. This probably should be done every 6 months.

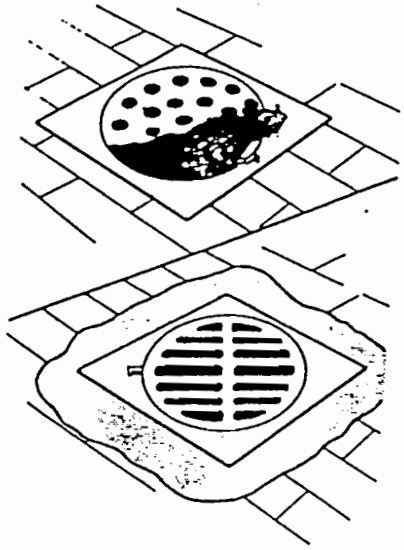

Fig. 9. Replace broken or defective drain covers.

A rodent- and bird-proofed structure, once cleared of any residual pest infestation, should be permanently free of vertebrate pest problems inside for as long as pest-proof measures are maintained (Fig. 11).

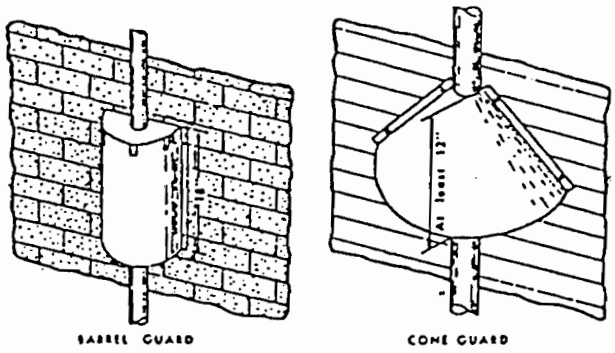

Fig. 10. Rat guards on roof drain pipes.

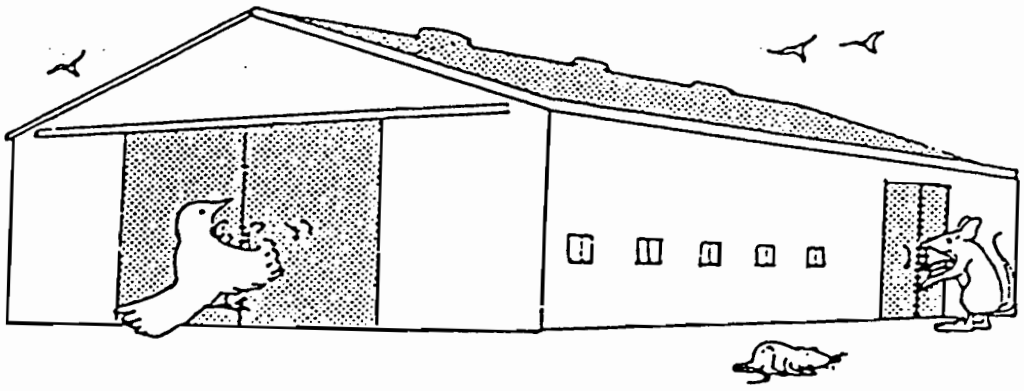

Fig. 11. A bird and rodent-proofed grain storage structure should be permanently free of pest problems.